# Chapter 3. San Francisco Bay Hydrologic Region

## Setting

### Topography, Hydrology and Climate

The San Francisco Bay Hydrologic Region, which occupies parts of nine counties, extends from southern Santa Clara County north to Tomales Bay in Marin County, and inland to the confluence of the Sacramento and San Joaquin Rivers near Collinsville. The eastern boundary follows the crest of the Coast Range, the highest peaks of which are more than 3,000 feet above sea level. Streams in the region flow into the Bay-Estuary or to the Pacific Ocean. The climate within the region varies significantly from west to east. Coastal areas are typically cool and often foggy and inland valleys are warmer, with a Mediterranean-like climate. Rainfall amounts vary among sub-regions and can be highly influenced by vegetative cover and marine influences. The region does not have a lot of natural lakes or built reservoirs and relies chiefly on water storage in adjacent and remote counties for its stored supplies.

### Land Use

Portions of the region are highly urbanized and include the San Francisco, Oakland, and San Jose metropolitan areas. Agricultural acreage occurs mostly in the north and northeast in Napa, Marin, Sonoma, and Solano counties. Santa Clara and Alameda counties also have significant agricultural acreage at the edge of the urban development. The predominant crops are grapes along with fruit and nut trees, hay production, and dairy and livestock operations. In the area along the ocean coastline south of the Golden Gate, more than half of the irrigated acres are in high value specialty crops, such as artichokes, strawberries or flowers.

The Bay Region boasts significant Pacific Coast marshes such as Pescadero marsh and Tomales Bay marshes as well as San Francisco Bay itself. San Francisco Bay is an estuary with a deep central channel, broad mudflats and fringing marsh. The Bay is commonly divided in to the South, Central, and North Bay. The North Bay is more brackish while the South and Central bays are more marine dominated. Suisun Marsh in between the North Bay and the Delta is the largest contiguous brackish water marsh remaining on the west coast of North America, providing more than 10 percent of California's remaining wetlands. The combined flows of the Sacramento and San Joaquin watersheds flow through the Delta and into the Bay. Delta outflow interacts with tides to determine how far salt water intrudes from the ocean into the San Francisco Bay Estuary. The resulting salinity gradients influence the distribution of many estuarine fishes and invertebrates as well as plants, birds, and animals in wetlands areas. Delta outflow varies with hydrology, reservoir releases, and diversions upstream.

### Population and Water Use

The Bay Region is a heavily urbanized region. The Association of Bay Area Governments projects that even with the implementation of “Smart Growth” policies by local government, the nine counties that include the Bay Region will add 2 million people, 750,000 households and create 1.5 million jobs by 2030. Water use in the Bay Region is predominantly urban with over 50 percent of the use being residential. There are also numerous industrial users around the Bay. Agricultural use is a smaller percentage of total water use in this region than in the Sacramento, San Joaquin, and Delta. For example, in the Santa Clara Valley Water District service area, agricultural use is 29,200 AF out of total water use of 383,300 AF/Yr, which is less than 10 percent.

## Water Supplies

In the early 1900s, local water agencies developed significant imported water supplies from the Mokelumne and Tuolumne Rivers to meet the anticipated demands. At the same period of time, local reservoirs and watersheds were being developed to capture surface supplies, to recharge the groundwater basins and to act as terminal reservoirs for the larger projects. Later, state and federal water projects brought water to the northern, eastern, and southern parts of the region through a number of canals.

The following table shows the sources of imported water for the area:

| Water Conveyance Facility | Water source | Operator | Counties Served | Water supplied to the Bay Region via facility in 2000 |
|---|---|---|---|---|
| Hetch Hetchy Aqueduct | Tuolumne River | SFPUC | San Francisco, San Mateo, Alameda, and Santa Clara counties | 32% |
| Mokelumne Aqueduct | Mokelumne River | EBMUD | Alameda, Contra Costa counties | 25% |
| South Bay Aqueduct | Delta | DWR (SWP) | Alameda, Contra Costa, Santa Clara counties | 15% |
| San Felipe Unit | Delta via San Luis Reservoir | USBR (CVP) | Santa Clara County | 8% |
| Contra Costa Canal | Western Delta | CCWD/CVP | Contra Costa County | 7% |
| North Bay Aqueduct | Northern Delta | DWR (SWP) | Solano, Napa counties | 4% |
| Putah South Canal | Lake Berryessa | USBR | Solano County | 4% |
| Sonoma Petaluma Aqueduct | Russian River | SCWA | Sonoma County | 4% |

## Groundwater

Local groundwater accounts for only about five percent of the region's average water year supply. The more heavily used basins include the Santa Clara Valley, Livermore Valley, Niles Cone, Napa-Sonoma Valley, and Petaluma Valley Groundwater Basins. Groundwater resources continue to be investigated and developed in some areas of the Bay Region.

## Recycled Water

Recycled water in the Bay Region is used in a full spectrum of applications, including landscape irrigation, industrial cooling, agricultural needs and as a supply to the areas many wetlands.

## Role of Conservation

Urban water districts in the Bay Region generally are signatories to the Memorandum of Understanding Regarding Urban Water Conservation in California (MOU) that commits them to make a good faith effort to implement Best Management Practices (BMPs). In 2001, the California Urban Water Agencies issued a report that projected net water savings for the Bay Region based on implementation of the MOU at about 105,000 acre-feet. These numbers are being updated and revised by the CALFED Bay-Delta Water Use Efficiency Program as part of their planning process.

The six agencies that participate in the Bay Area Water Agencies Coalition, SFPUC, SCVWD, CCWD, EBMUD, ACWD, and Zone 7, recently completed a study on conservation advancement that showed that

as a whole, their members had reduced the per capita water use by 16 percent since 1986 and decreased total water use by 1.4 percent despite a 17 percent increase in population served during the same time period. Individual agency results varied around these numbers.

### Drinking Water Quality

The quality of San Francisco Bay Region drinking water supplies varies by source. The source water quality of San Francisco Public Utility Commission's Hetch Hetchy supply, East Bay Municipal Utility District's Mokelumne River supply, and local surface and groundwater supplies is generally higher than that of water diverted from the Delta.

Users that rely on Sierra sources are generally interested in protecting their existing water quality. Urban districts that depend on the Delta for part of their drinking water all meet current drinking water standards but remain concerned about issues such as salinity and about the cost to meet future water quality standards because of the risk of degradation of Delta water quality and increasingly stringent drinking water quality standards. About a third of the water brought into the Bay region comes from the Delta.

### Environmental Water Quality:

The Bay Region receives contaminants from point and non-point sources in the highly urbanized watershed, as well as inputs from Napa, Petaluma and Guadalupe Rivers and the Sacramento San Joaquin Delta. The Bay acts as a sediment repository, so persistent sediment-bound contaminants, such as mercury, dioxins, PCBs, and organochlorine pesticides have accumulated over time throughout the Bay. These compounds bioaccumulate in the food chain, causing high levels of contaminants in fish that may also affect consumers of bay fish, including humans and wildlife. Water quality can also be affected by shorter-term exposures to metals, pesticides, and other toxic compounds that can be in the river inputs or associated with runoff in the bay watershed. Other water quality concerns include copper and nickel in the South Bay, selenium from Contra Costa refineries, erosion from vineyards in Napa and Sonoma Valleys, pesticides in urban creeks generally, and toxicity of water and especially sediment.

Because the Bay has several active marine ports, another water quality issue is discharge of ballast water and vessel wastes. In addition there is a need for maintenance dredging and disposal of contaminated sediments.

Outside of the San Francisco Bay Estuary, Tomales Bay is one of only four commercial shellfish growing areas on the entire west coast. Some of the coastal watersheds of Marin and San Mateo counties provide important habitat for listed species of coho salmon and steelhead. Sediment threatens water quality (need to identify source of sediment?) and habitat in Bolinas Lagoon, the only wetland on the West Coast designated as a Wetland of International Significance by USFWS.

### Wetlands and Watershed Management

The San Francisco Bay is one of the most modified estuaries in the United States. The topography, ebb and flow of the tides, patterns of freshwater inflows locally and from the Delta, and the availability and types of sediment have all been altered. Many new species of plants and animals have been introduced. These exotic and invasive species, such as the Chinese mitten crab and Asian clam, threaten to undermine the estuary's food web and alter its ecosystem. Water quality has also changed over time. The character of the wetlands around the Bay has changed dramatically. Over 75 percent of the Bay's historical wetlands have been lost or altered through a variety of land use changes around the bay including filling for urban

and industrial uses and diking for agricultural uses. There used to be 190,000 acres of tidal marsh, now there are 40,000 acres with only 16,000 of these having been tidal marsh historically. Tidal flats have been reduced from 50,000 acres to 29,000 acres due to bay fill, erosion, tidal marsh evolution, and other factors. The total area covered by the Bay at high tide was historically about 516,000 acres. Now the Bay covers about 327,000 acres at high tide. There are about 500 species of fish and wildlife associated with the baylands, twenty of which are now threatened or endangered. In recent decades, filling of the Bay has slowed significantly due to regulatory changes and the creation of the Bay Conservation and Development Commission, a state agency charged with permitting activities along the shore of the Bay.

## State of the Region

Some of the major water related challenges facing the Bay Region include improving water supply reliability to sustain water supplies in drought periods and other emergency outages, maintaining and improving drinking water quality across the region by continuing to meet and exceed current and anticipated drinking water quality standards and protecting drinking water sources, and improving the ecosystem health of San Francisco Bay. Other challenges include linking local land use planning with water system planning and improving water management planning on a regional level.

Many projects and programs are already underway to address these needs. However, the various parties concerned with water related issues in the Bay Region are increasingly recognizing that there is also a need to develop solutions on a more collaborative regional or sub-regional basis. Some of the long-standing regional planning efforts within the Bay Region that address ecosystem restoration issues are described in this section. Some of the emerging water management and drinking water quality regional planning initiatives are described in the next section, “Looking to the Future.”

### Water Supply Reliability

Generally, Bay Region water districts have sufficient supplies to meet the needs of their customers in normal water years now and for some time into the future. The major water supply reliability challenges occur during droughts and other emergencies. Currently, during drought periods, locally developed water supplies are very limited and imported water supplies can be short of water users needs. This problem is expected to worsen over time as the region’s urban use grows and because these imported supplies may be more at risk due to various other factors. For example, area of origin communities outside the San Francisco Bay Region will also need more water as they grow. Some are concerned that water could be reallocated for environmental needs or changes in Delta outflow and operational requirements could also affect the San Francisco Bay Regions’ imported water supply.

Some examples of future shortfall estimates are:

- Santa Clara Valley Water District’s (SCVWMD) 2001 Urban Water Management Plan shows a supply shortfall in a repeat of the most severe single dry year in 2020 of over 250,000 AF or 60 percent of the projected demand.
- East Bay Municipal Utility District (EBMUD), without the Freeport Project, faces customer rationing at 68 percent in 2020. With Freeport, rationing would be reduced to 25 percent during anticipated dry periods.

The exact magnitude of drought year shortfalls and the best water management tools to be used to address them are, not surprisingly, controversial. Each district has different assumptions and policies that guide their planning. Different systems rely on water from different watersheds so even the definition of a

drought for planning purposes varies somewhat. However, drought supply reliability will continue to be a major challenge for water supply planning in the Bay Region.

The Bay Region is also prone to major earthquakes and other natural disasters that could damage and interrupt water delivery. Critical seismic reliability upgrades are required for some facilities that cross or are located on any of the three active earthquake fault systems (i.e., San Andreas, Hayward, and Calaveras Faults). According to San Francisco Public Utilities Commission (SFPUC), a major earthquake could disrupt water supplies for up to 60 days in their system, which serves 2.4 million people in the Bay Region. In other areas, significant progress has already been made on seismic vulnerability but challenges remain.

Each water district has plans underway to address these drought shortfalls and to ensure that their systems will provide a certain level of water service in the event of an earthquake or natural disaster. Details such as future projected water demands, supplies, and planned capital expenditures can be found in each district's plans. However, there currently aren't statistics that summarize the current and future expenditures neither planned region-wide nor for the amount of water expected to be developed for droughts or the expected performance region wide in the event of a seismic event. This is the type of information that may become available through integrated resources planning.

Some examples of projects underway to address future reliability needs are described in the following sections. In addition to the example projects listed here, there are numerous other efforts underway.

## Seismic Vulnerability and Drought Supply Planning

- SFPUC is currently implementing a $3.6 billion capital improvement program to replace or repair of aging facilities, provide seismic upgrades and improve water supply reliability.
- EBMUD is near completion of a 10-year seismic improvement program (SIP). The SIP is a $189 million program to improve post-earthquake firefighting capability and water service within the EBMUD service area.
- Zone 7 is updating its Well Master Plan so that it can more readily rely on groundwater to meet its normal demands if a seismic event disrupts the imported water delivery system.
- SCVWD is implementing and updating its integrated water resources plan to address water supply shortfalls and preparing a comprehensive water utility infrastructure management program to address seismic and security hazards.
- CCWD recently completed the major components of its $120 million Seismic Reliability Improvements program, including a 21 mile Multi-purpose Pipeline, a new pumping plant at its Mallard Slough Intake, interties and seismic valves. These facilities improve reliability and fire-fighting flows after a major earthquake.

## Groundwater

South Bay Aqueduct contractors have entered into agreements with groundwater banks outside the region to make water available in droughts and have implemented local conjunctive use programs. The Bay-Delta Program has invested $2.4 million in eight local groundwater projects in areas like Santa Clara County.

# Conveyance and Interconnections

- East Bay Municipal Utilities District, in conjunction with the Sacramento County Water Agency, is currently preparing preliminary design documents to divert water from the Sacramento River to reduce customer rationing during multi-year droughts.
- A 40 mgd intertie between the SCVWD system and the SFPUC system was completed recently. EBMUD and SFPUC are also expecting to begin construction on a 40 mgd intertie between their systems shortly.
- Studies are underway on the San Luis Low Point Improvement Project (SLLPIP) to address water quality and conveyance issues for South Bay water users and to improve the reliability of water supplies from San Luis Reservoir for the customers of the San Felipe Unit of the Central Valley Project including SCVWD. Additional details on the SLLPIP including schedule and budget can be found in the CALFED Bay-Delta Program Plan for the Conveyance Program.

## Water Conservation and Recycling

Many different wastewater reclamation/recycling projects are underway or in study and environmental documentation stages. The Bay Area Regional Water Recycling Program (BARWRP) Water Recycling Project Master Plan, prepared in 1999, analyzed recycling for the counties of San Francisco, San Mateo, Santa Clara, Alameda and Contra Costa and developed a plan to achieve 125,000 AF/yr of water recycling over the next 10 years.

BARWRP also had a number of recommendations to make reclamation and recycling more implementable on a regional basis including increasing public acceptance and dealing with environmental impacts regionally. Many of the near term recycling project identified in the plan are now being developed, some with $43 million in Bay-Delta program funding. BARWRP members are reviewing overall progress and these recommendations and updating the program. A similar coordinated recycling program is underway in the North Bay.

Water conservation is generally included in each agencies planning and the CALFED Bay-Delta Program has invested over $15 million in 35 local water conservation programs.

## Surface Storage

Water agencies are also studying several surface storage projects within the region and in other regions to help with drought relief, emergency storage, and water quality management. Some of the surface water storage projects under consideration in the region include expansion of Calaveras, Pacheco, and Los Vaqueros reservoirs. Calaveras Reservoir is being studies as part of the SFPUC Capitol Improvement Plan to provide water supply reliability to SFPUC customers. Los Vaqueros expansion is being evaluated as part of the CALFED Program. This project is being studied both as a way to improve drought supply reliability and water quality for the Bay Region. Studies of the potential for expansion of Los Vaqueros are underway. Additional details on the schedule and budget for this project can be found in the CALFED Bay-Delta Program Plan for Storage. Expansion of Pacheco Reservoir is being considered by CALFED as an alternative under the SLLPIP. Additional information on this project can be found in the CALFED Bay-Delta Program Plan for Conveyance.

## Desalination

With recent advances in technology, several water agencies in the Bay Region are investigating desalinization as a source to improve water supply reliability. Marin Municipal Water District is

proposing a major new desalination project for Marin County using water from San Rafael Bay. EBMUD, CCWD, SCVWD and SFPUC are conducting a joint feasibility study for a desalinization plant to serve the Bay Region as an emergency or dry-year supply. Alameda County Water District has built a brackish water desalination plant to produce potable water from brackish water taken from local aquifers.

### Drinking Water Quality

Water users that rely on Sierra sources are generally interested in protecting their existing high water quality. There are some particular issues such as SFPUC's Hetch Hetchy supplies are unfiltered and use a disinfection strategy that can result in high levels of disinfection by-products.

Most districts that deliver water from the Delta are pursuing a range of projects to protect and improve the quality of the water that they serve. These projects include increased ability to store water when quality is good, source control, and improved treatment of drinking water supplies.

The storage of higher quality Delta water in Los Vaqueros Reservoir completed in 1998, as well as implementation of advanced water treatment, has significantly improved the water quality in the service area of the Contra Costa Water District. CCWD is continuing to work with local and regional agencies and CALFED to improve source water quality. Examples include CALFED funded projects to relocate agricultural drains and line some of the unlined portions of the Contra Costa Canal that are impacted by local groundwater.

Utilities in Solano County utilize a blend of local surface water and Delta water of variable quality delivered via the North Bay Aqueduct. The Bay-Delta program, working with Solano County, is improving watershed management near the intake for the NBA and evaluating intake relocation.

Santa Clara Valley Water District, Alameda County Water District, and Zone 7 Water Agency employ a diversified portfolio of Delta water, local surface water, and groundwater coupled with advanced treatment to meet water quality standards.

The CALFED Bay-Delta Program has funded several efforts to improve water quality in the region including the evaluation of the proposed expansion of Los Vaqueros Reservoir previously discussed under "Storage", the SLLPIP discussed under "Conveyance", and the Bay Area Water Quality and Supply Reliability program which is evaluating a broad array of cooperative regional projects to benefit ACWD, Zone 7, SFPUC, BAWSCA, CCWD, SCVWD, and EBMUD. Some of the regional project concepts being considered in this study include the expansion of storage in Calaveras and Los Vaqueros reservoirs, additional recycling, additional conservation beyond existing BMPs, and desalination. Details on schedule and budget for the BAWQWSRP can be found in the CALFED Bay-Delta Program Plan for the Drinking Water Quality Program.

In general, groundwater quality throughout most of the region is suitable for most urban and agricultural uses with only local impairments, such as leaking underground storage tanks. Groundwater in the Livermore Valley and Niles Cone (southern Alameda County) basins has high levels of total dissolved solids, chloride, boron, and hardness; both Zone 7 and ACWD are implementing wellhead demineralization projects to improve groundwater basin and delivered water quality. Meanwhile, parts of the basin underlying the Santa Clara Valley are threatened by pollutants from various industrial activities and historic agriculture. Elsewhere, groundwater in Petaluma Valley and the Gilroy-Hollister Valley has

high levels of nitrate impacting domestic use of wells. Recharge projects and use of imported water has successfully stopped or reversed seawater intrusion into aquifers around the Bay.

### Environmental Water Quality:

Water and sediment of the Estuary meet cleanliness guidelines for most contaminants, with constituents in water meeting toxicity and chemical guidelines about 87 percent of the time. Sediment concentrations were more problematic due to the legacy pollutants – only about 60 percent of the sediment samples met chemical guidelines and passed toxicity tests. Over the long term, water quality has shown significant improvement with less toxic episodes, decreased silver concentrations in the south bay and improved oxygen levels. These improvements are largely due to improved wastewater treatment methods, and reductions in the use of organophosphate pesticides, and other contaminant control strategies. On the other hand, new contaminants are emerging that may be causing impacts to the aquatic ecosystem, including PBDEs (polybrominated Diphenyl Ethers), pyrethroid insecticides, and chemicals from pharmaceuticals and personal care products.

Actions have begun to control new inputs of the persistent sediment contaminants in the bay. Most organochlorine pesticides and PCBs have been banned from use, and the concentrations in the sediments and in organisms appear to be declining. The San Francisco Regional Water Quality Control Board is developing TMDLs (Total Daily Maximum Loads) to address the mercury sources to the bay, which include the New Almaden mine, as well as mercury loads from the Sacramento-San Joaquin delta related to the thousands of abandoned mercury and gold mines in the central valley watershed. Mercury contamination in bay fish, such as the striped bass has remained high for more than 30 years. There is also concern that wetland restoration around the bay could increase mercury methylation processes and cause higher contamination in the fish. The CALFED Bay Delta Program, and other organizations, have funded a number of studies to determine potential effects of restoration and explore management actions that would decrease methyl mercury production and bioaccumulation.

Since 1993, the San Francisco Regional Monitoring Program has been providing monitoring and synthesis of findings on water, sediment and fish contamination issues in the bay. The annual conference and publication “Pulse of the Estuary” is produced by the San Francisco Estuary Institute and summarizes the state of what is known about the bay’s water quality issues. In addition to the mercury research mentioned previously, the CALFED Bay Delta Program has funded $10 million in projects related to water quality in the bay, including watershed management, pesticide use reduction, and toxicity studies.

### Wetlands and Watershed Management

Although there are serious problems facing San Francisco Bay, its wetlands, and watershed, there has been a concerted effort over the last 20 years to restore the Bay. Some of the major planning and implementation efforts are described here. Expenditures to date on ecosystem restoration include $32 million in Bay-Delta Program funding, along with significant local, state and federal funding.

The Comprehensive Conservation and Management Plan completed by the San Francisco Estuary Project in 1993, presents a blueprint of 145 specific actions to restore and maintain the chemical, physical and biological integrity of the Bay and Delta. The CCMP has been implemented over time by a wide variety of local, state and federal partners including the CALFED Bay-Delta Program. The Estuary Project regularly updates the priorities for CCMP implementation and prepares a report on the State of the Estuary. In addition, the Estuary Project prepares Bay-Delta Report card that identifies many of the

restoration projects underway to track progress implementing the CCMP. The most recent priorities identified by Estuary Project are:

- Reduce the impact of invasive species on the estuary through prevention, control, eradication, and education.
- Expand, restore, and protect Bay and Delta Wetlands and contiguous habitats. (These two priorities were both identified as top priorities)
- Protect and restore watersheds, including promoting creek restoration, throughout the Estuary.
- Create "incentives" that motivate governments, landowners, businesses and communities to protect and restore the Estuary.
- Minimize or eliminate pollution of the Estuary from all sources.
- Increase public interaction with the Estuary's natural resources, encourage stewardship, and promote the values ecological processes provide to human activities and the effects of human activities on them.
- Continue, sustain, and expand the regional monitoring program to address all key CCMP issues including pollution, wetlands including mitigation measures, watersheds, dredging and sediment transport, biological resources, land use and flows and integrate scientific monitoring results into management and regulatory actions.
- Promulgate baseline inflow standards for San Francisco, San Pablo, and Suisun Bays to protect and restore the Estuary.

The Baylands Ecosystem Habitat Goals Report, prepared by the Habitat Goals Project in 1999 is a guide for restoring and improving the baylands and adjacent habitats of the San Francisco Estuary. It provides recommendations for the kinds, amounts, and distribution of wetlands and related habitats that are needed to sustain diverse and healthy communities of fish and wildlife resource in the Bay. The CCMP originally identified the need for these types of habitat goals. The recommendations are being implemented over time through voluntary restoration efforts that include many local, state and federal partners.

The Implementation Strategy for The San Francisco Bay Joint Venture, prepared in 2001 identified actions in the Habitat Goals Report that were consistent with the Joint Venture's objectives. The state and federal partners in the Joint Venture are implementing these actions.

State, Federal, and local governments, landowners, and nonprofit agencies have been working cooperatively to restore the San Francisco Bay estuary for a number of years in conjunction with these and other planning processes. Because the restoration and watershed management projects around the Bay are so numerous, each one is not listed individually. Additional information can be found on websites for groups active in restoration such as the San Francisco Bay Joint Venture (www.sfbayjv.org), the Wetlands Regional Monitoring Program's Wetlands Tracker (ww.wrmp.org) or the Estuary Project's Report Card (www.abag.ca.gov/bayarea/sfep.org). A few of the largest efforts are described here.

The Napa Sonoma Marsh Project is joint State Federal and local project to restore 10,000 acres of wetlands and associated habitats within the former Cargill salt pond complex in the North Bay. It includes habitat restoration, beneficial use of recycled water, and improved water quality in the Napa River and the Bay. The Bel Marin Keys and Hamilton Airfield projects will collectively restore over 2400 acres of diked historical wetlands in the North Bay along the Marin County shoreline. These three projects, along with many smaller North Bay projects, will provide significant restoration of wetlands and associated

uplands. In 2003, the State of California and the Federal government approved the purchase and restoration of 15,100 acres of Cargill's salt ponds in the South San Francisco Bay.

Acquisition of the South Bay salt ponds provides an opportunity for landscape-level wetlands restoration, improving the physical, chemical, and biological health of the San Francisco Bay. The South Bay Salt Pond Restoration Project will integrate restoration with flood management, while also providing for public access, wildlife-oriented recreation, and education opportunities. The Project will restore and enhance a mosaic of wetlands, creating a vibrant ecosystem. Restored tidal marshes will provide critical habitat for the endangered California clapper rail and the salt marsh harvest mouse. Large marsh areas with extensive channel systems will also provide habitat for fish and other aquatic life and haul out areas for harbor seals. In addition, the restored tidal marshes will help filter out and eliminate pollutants. Many of the ponds will remain as managed ponds and be enhanced to maximize their use as feeding and resting habitat for migratory shorebirds and waterfowl traveling on the Pacific Flyway.

Flood management will be integrated with restoration planning, to ensure flood protection for local communities. Where feasible, flood capacities of local creeks, flood control channels, and rivers will be increased by widening the mouths of the waterways and reestablishing connections to historical flood plains. As ponds are opened to the tide, levees between the newly created tidal marsh and local communities will need to be built or enhanced to provide flood protection.

The acquisition of such a large area of open space in the South Bay will allow for the provision of public access, wildlife-oriented recreation, and education opportunities, to be planned concurrently with restoration and flood management. Public uses could include creation of Bay Trail segments for biking and hiking, and provision of hunting and angling opportunities, bird watching, environmental education, and other recreational opportunities.

In the Suisun Marsh, the Suisun Mash Charter Group was formed in 2001 to resolve issues including recovery of endangered species, amendment of the Suisun Marsh Preservation Agreement, issuance of a USACE Regional General Permit, and implementation of a Suisun Marsh Levee Program. The Charter Group was charged with developing and analyzing a plan for the Suisun Marsh that would outline the actions necessary to preserve and enhance managed seasonal wetlands, restore tidal marsh habitat, implement a comprehensive levee protection/improvement program, and protect ecosystem and drinking water quality, consistent with the California Bay-Delta Program's goals and objectives. The proposed Suisun Marsh Plan would balance the goals and objectives of the Bay-Delta Program, SMPA, Federal and State Endangered Species Acts, and other management and restoration programs within the Suisun Marsh in a manner that is responsive to the concerns of all stakeholders and is based upon voluntary participation by private landowners. The proposed Suisun Marsh Plan also would provide for simultaneous protections and enhancement of: (1) The Pacific Flyway and existing wildlife values in managed wetlands, (2) endangered species, (3) tidal marshes and other ecosystems, and (4) water quality, including, but not limited to the maintenance and improvement of levees.

Restoration efforts focused on the upper watershed lands above the baylands are also underway. A wide variety of local groups and agencies have watershed management initiatives underway aimed at controlling pollution at the source, identifying contaminants of concern, and protecting watershed habitat. These are usually multi-objective efforts that can be addressing needs such as flood control, storm water management, habitat restoration, recreation, and open space. Local government agency and region-wide

efforts are underway to control storm water runoff to Bay Region waterways, to initiate innovative land use development and agricultural practices and to improve wastewater discharges—leading to higher water quality for human and livestock consumption.

The Santa Clara Basin Watershed Management Initiative (SCBWMI) is one example of a collaborative, stakeholder driven effort among representatives from regional and local public agencies; civic, environmental, resource conservation and agricultural groups; professional and trade organizations; business and industrial sectors; and the general public, to protect and enhance the Santa Clara Basin watershed, creating a sustainable future for the community and the environment. The State Watershed Task Force recognized the SCBWMI as one of the top ten watershed partnerships in California through AB 2117. Its successes include the adoption of achievable and protective numeric standards for copper and nickel for lower South San Francisco Bay, adoption of wastewater discharge permits and multi-year stream maintenance permits, watershed education and outreach programs and collaborative efforts to address linkages between watershed management, flood protection and other land use and development activities.

The Bay Area Water Agencies Forum (formerly known as the Six Agencies Group) was first convened in 2000 to provide a regular opportunity for water agency policy makers to discuss regional water policy issues and explore cooperative approaches to improving the quality and reliability of Bay Area water supplies.

The Bay Area Water Agencies Coalition was established in 2002 to provide a forum and a framework to discuss water management planning issues and coordinate projects and programs to improve water supply reliability and water quality.

The ABAG-CALFED Task Force is a regional body of elected officials from local government and water districts, staff and non-governmental organizations that was formed to

- Restore and maintain a healthy Bay;
- Protect the legitimate interests of Bay Area communities;
- Provide a unified Bay Area voice into the CALFED program;

Help coordinate CALFED projects with the needs of Bay Area communities, and
Help coordinate the existing Bay Area Alliance for Sustainable Development and other planning efforts with the water supply directions developed by CALFED.

The ABAG/CALFED Task Force is also guided by a set of water management, regional integration, funding, environmental and representation goals. Develop a dialogue on Bay Area issues.

## Looking to the Future

The San Francisco Bay Hydrologic Region is home to a multitude of planning organizations that seek to identify future trends and the challenges that accompany them. These groups are working on issues of land use, housing, environmental quality, and economic development, wetlands, water reliability, watershed management, groundwater management, water quality, fisheries, and ecosystem restoration.

Most, if not all, of the water supply agencies in the Bay Region have undergone integrated water resource planning processes involving stakeholders in their regions including local land use planners and are implementing the adopted strategies to improve water supply reliability. These strategies call for the implementation of a diverse portfolio of water management actions including: conservation, recycling, desalination, conjunctive use, dry year transfers, banking and storage development.

Many local governments are now routinely evaluating or considering water supply plans as they conduct their land use planning through cooperative efforts with the agencies responsible for water supply.

However, until recently, integrated water management planning has not been coordinated among the various sub-regions of the Bay Region and has not systematically combined water supply reliability, water quality, storm water and wastewater management and environmental restoration planning together. A number of regional associations, including BAWAC, North Bay water districts, and BACWA are working under a Letter of Mutual Understandings that sets up a planning framework to develop such an integrated regional water management plan for the entire nine-county Bay Area. Parties involved in developing the report sections focusing on water supply and drinking water quality expect it to be completed by summer, 2004 while efforts to compile other sections of the report will continue.

This effort to develop a broad based multi-regional integrated water management plan for the nine-county Bay Region is very broad in its vision and scope. Although BAWAC invited other regional agencies and organizations responsible for various aspects of water management to participate, some have not been involved due to lack of funding.

**Ongoing planning organizations**

- The Association of Bay Area Governments (ABAG) CALFED Task Force
- Bay Area Water Agencies Coalition (BAWAC)
- Bay Area Wetlands Restoration Program
- Bay Area Regional Water Recycling Program (BARWRP)
- Fish Passage Improvement Program
- San Francisco Estuary Institute
- Audubon Society – S.F. Bay Restoration Program
- S.F. Bay Area Pollution Prevention Group (BAPPG)
- Bay Area Stormwater Management Agencies Association (BASMAA)
- Bay Area Clean Water Agencies (BACWA)
- San Francisco Bay Conservation and Development Commission (BCDC)
- San Francisco Estuary Project (SFEP)
- SF Bay Area Regional Water Quality Control Board (RWQCB) – SF Bay Basin Plan

These efforts at integrating regional water management and planning can benefit the Bay Region in many ways by facilitating implementation of innovative, cost-effective and efficient multi-objectives water management solutions. For instance, by demonstrating how recycling and water use efficiency are being incorporated, they can increase public support for the plan as a whole. Through an integrated plan, the Bay Region may also better compete for funding from broader sources such as state bond funds or federal appropriations. Some of the largest projects in the region such as expansion of Los Vaqueros, will likely require multiple agencies to agree to participate and finance the effort. These types of regional agreements may be more easily reached with regional planning.

Efforts to develop a regional approach to water management can also benefit the state. As regional water management planning moves forward, regional information on current conditions and future planning is expected to become more readily available. This regional information will complement the information being developed for future California Water Plans and will be an important part of measuring the performance of the CALFED Bay-Delta Program at meeting water quality and supply reliability goals. It will also help the State and federal government target expenditures at the highest priority regional needs.

Future Bay Region regional profiles are expected to incorporate information from integrated regional water management plans.

### Environmental Water Quality

More monitoring and studies are needed to determine the effects of contaminants, including the emerging contaminants, on the aquatic ecosystem of the bay. There are many challenges ahead to improve the water and sediment quality. As the population continues to grow in the bay area, stormwater runoff, particularly from urban areas will need to continue to improve and reduce contaminant loads to the estuary. TMDLs are being developed to try to address some of the major sources of contaminants such as PCBs and mercury, from both the bay and central valley. However, even if all the sources of these contaminants were removed, it would take a long time before sediment contaminants were reduced by degradation, transport to the ocean or atmosphere, or buried under new sediment deposits. Continued monitoring is needed to evaluate the effectiveness of management actions, detect long-term trends and investigate emerging issues from new contaminants.

### Wetlands and Watershed

With the large scale wetlands restoration underway around the Bay, there will need to be on-going monitoring and adaptive management to ensure that projects are meeting environmental objectives and integrating well with other water management objectives.

## Water Portfolios for Water Years 1998, 2000 and 2001

The following tables present actual information about the water supplies and uses for the San Francisco Bay hydrologic region. Water year 1998 was a wet year for this region, with annual precipitation at 185 percent of normal, while the statewide annual precipitation was 170 percent of average. Year 2000 represents nearly normal hydrologic conditions with annual precipitation at 110 percent of average for the San Francisco Bay region, and year 2001 reflected dryer water year conditions with annual precipitation at 85 percent of average. For comparison, statewide average precipitation in year 2001 was 75 percent of normal. Table 3-1 provides more detailed information about the total water supplies available to this region for these three specific years from precipitation, imports and groundwater, and also summarizes the uses of all of the water supplies. The three Water portfolio tables included in Table 3-2 and companion Water Portfolio flow diagrams Figures 3-2, 3-3 and 3-4 provided more detailed information about how the available water supplies are distributed and used throughout this region.

A more detailed tabulation of the portion of the total available water that is dedicated to urban, agricultural and environmental purposes is presented in Table 3-3. Because most of the San Francisco Bay region is largely urbanized, most of the developed water is supplied to urban purposes. By comparison, agricultural and dedicated environmental water uses are a much smaller component of the total developed water uses in this region. Table 3-3 also provides detailed information about the sources of the developed water supplies, which are primarily from surface water systems and include a large percentage of water imports from other regions.

### Sources of information

- Water Quality Control Plan, Regional Water Quality Control Board
- Watershed Management Initiative Chapter, Regional Water Quality Control Board
- 2002 California 305(b) Report on Water Quality, State Water Resources Control Board
- Bulletin 118 (Draft), California's Groundwater, Update 2003, Department of W
- ater Resources
- Nonpoint Source Program Strategy and Implementation Plan, 1998-2013, State Water Resources Control Board, California Coastal Commission, January 2000
- Strategic Plan, State Water Resources Control Board, Regional Water Quality Control Boards, November 15, 2001
- 2003 Pulse of the Estuary, San Francisco Estuary Institute

**Figure 3-1**
**San Francisco Bay Hydrologic Region**

Revised April 2, 2004


**Some Statistics**

- Area - 4,506 square miles (2.8 % of State)
- Average annual precipitation – 25.4 inches
- Year 2000 population - 6,105,650
- 2030 projected population –
- Total reservoir storage capacity - 746 TAF
- 2000 irrigated agriculture - 70,200 acres

**Table 3-1**
**San Francisco Bay Hydrologic Region Water Balance Summary – TAF**

Water Entering the Region – Water Leaving the Region = Storage Changes in Region

| | 1998 (wet) | 2000 (average) | 2001 (dry) |
|---|---|---|---|
| **Water Entering the Region** | | | |
| Precipitation | 11,438 | 6,644 | 4,908 |
| Inflow from Oregon/Mexico | 0 | 0 | 0 |
| Inflow from Colorado River | 0 | 0 | 0 |
| Imports from Other Regions | 309 | 309 | 274 |
| **Total** | **11,747** | **6,953** | **5,182** |
| **Water Leaving the Region** | | | |
| Consumptive Use of Applied Water * (Ag, M&I, Wetlands) | 384 | 406 | 430 |
| Outflow to Oregon/Nevada/Mexico | 0 | 0 | 0 |
| Exports to Other Regions | 0 | 0 | 0 |
| Required Outflow to Salt Sink | 23 | 22 | 20 |
| Additional Outflow to Salt Sink | 703 | 725 | 762 |
| Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows | 10,631 | 5,710 | 4,178 |
| **Total** | **11,741** | **6,863** | **5,390** |
| **Storage Changes in the Region** [+] Water added to storage [–] Water removed from storage | | | |
| Change in Surface Reservoir Storage | 76 | -25 | -56 |
| Change in Groundwater Storage ** | -70 | 115 | -152 |
| **Total** | **6** | **90** | **-208** |

| | | | |
|---|---|---|---|
| **Applied Water *** (compare with Consumptive Use) | 1,123 | 1,167 | 1,231 |

* Definition - Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.

**Footnote for change in Groundwater Storage

Change in Groundwater Storage is based upon best available information. Basins in the north part of the State (North Coast, San Francisco, Sacramento River and North Lahontan Regions and parts of Central Coast and San Joaquin River Regions) have been modeled – spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and year 2001 were calculated using the following equation:

**GW change in storage =**

**intentional recharge + deep percolation of applied water + conveyance deep percolation - withdrawals**

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

# Table 3-2
# Water Portfolios for Water Years 1998, 2000 and 2001

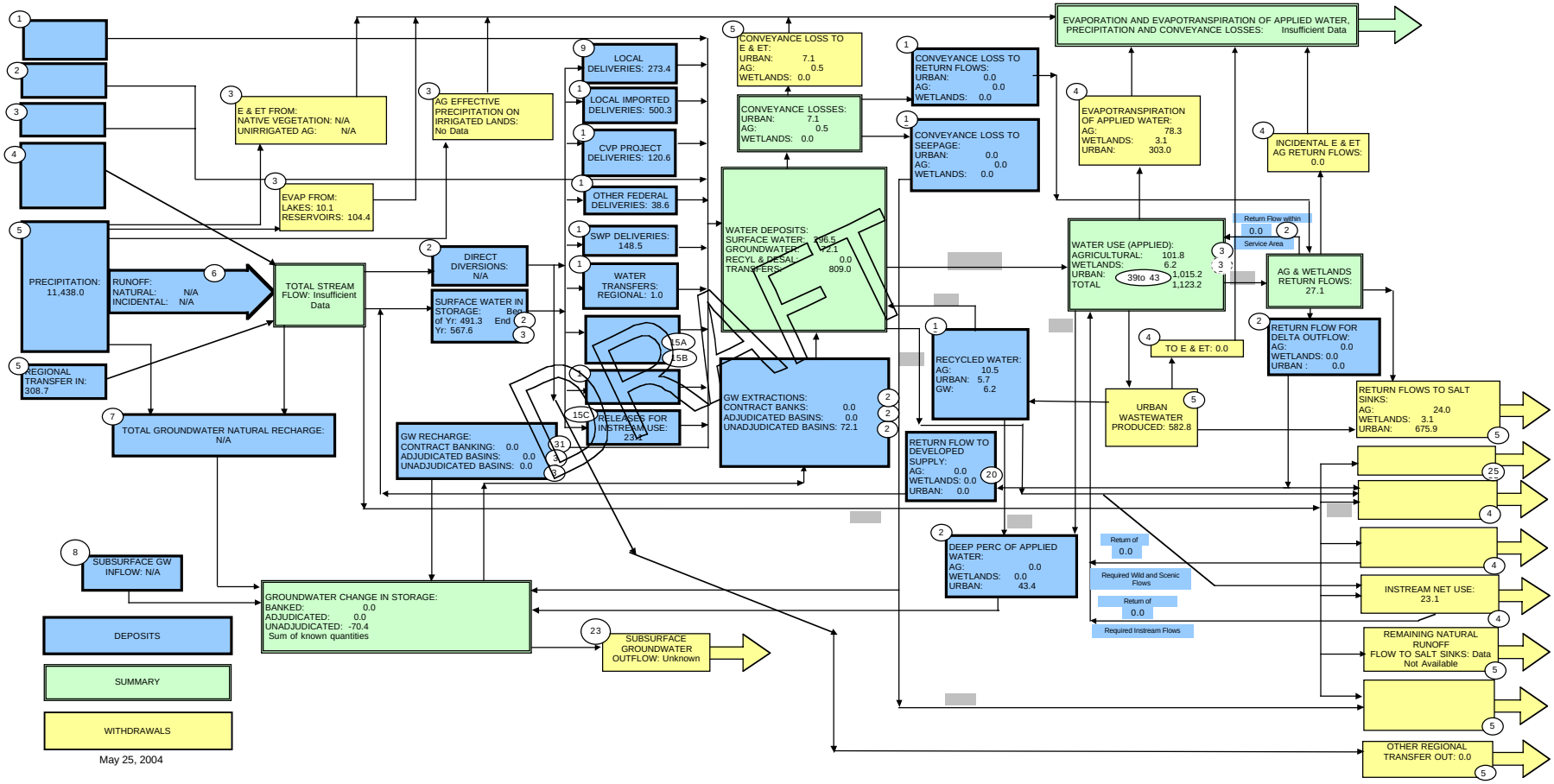
| Category | Description | San Francisco 1998 (TAF) | | | | San Francisco 2000 (TAF) | | | | San Francisco 2001 (TAF) | | | | Data |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Inputs:** | | Water Portfolio | Applied Water | Net Water | Depletion | Water Portfolio | Applied Water | Net Water | Depletion | Water Portfolio | Applied Water | Net Water | Depletion | **Detail** |
| 1 | Colorado River Deliveries | | - | | | | - | | | | - | | | PSA/DAU |
| 2 | Total Desalination | | - | | | | - | | | | - | | | PSA/DAU |
| 3 | Water from Refineries | | - | | | | - | | | | - | | | PSA/DAU |
| 4a | Inflow From Oregon | | - | | | | - | | | | - | | | PSA/DAU |
| b | Inflow From Mexico | | - | | | | - | | | | - | | | PSA/DAU |
| 5 | Precipitation | 11,438.0 | | | | 6,643.7 | | | | 4,908.0 | | | | REGION |
| 6a | Runoff - Natural | N/A | | | | N/A | | | | N/A | | | | REGION |
| b | Runoff - Incidental | N/A | | | | N/A | | | | N/A | | | | REGION |
| 7 | Total Groundwater Natural Recharge | N/A | | | | N/A | | | | N/A | | | | REGION |
| 8 | Groundwater Subsurface Inflow | N/A | | | | N/A | | | | N/A | | | | REGION |
| 9 | Local Deliveries | | 273.4 | | | | 241.9 | | | | 231.7 | | | PSA/DAU |
| 10 | Local Imports | | 500.3 | | | | 502.0 | | | | 529.9 | | | PSA/DAU |
| 11a | Central Valley Project :: Base Deliveries | | - | | | | - | | | | - | | | PSA/DAU |
| b | Central Valley Project :: Project Deliveries | | 120.6 | | | | 118.1 | | | | 114.7 | | | PSA/DAU |
| 12 | Other Federal Deliveries | | 38.6 | | | | 34.5 | | | | 37.7 | | | PSA/DAU |
| 13 | State Water Project Deliveries | | 148.5 | | | | 155.6 | | | | 121.3 | | | PSA/DAU |
| 14a | Water Transfers - Regional | | 1.0 | | | | 1.0 | | | | 0.2 | | | PSA/DAU |
| b | Water Transfers - Imported | | - | | | | - | | | | - | | | PSA/DAU |
| 15a | Releases for Delta Outflow - CVP | | - | | | | - | | | | - | | | REGION |
| b | Releases for Delta Outflow - SWP | | - | | | | - | | | | - | | | REGION |
| c | Instream Flow | | 23.1 | | | | 21.5 | | | | 20.0 | | | REGION |
| 16 | Environmental Water Account Releases | | - | | | | - | | | | - | | | PSA/DAU |
| 17a | Conveyance Return Flows to Developed Supply - Urban | | - | | | | - | | | | - | | | PSA/DAU |
| b | Conveyance Return Flows to Developed Supply - Ag | | - | | | | - | | | | - | | | PSA/DAU |
| c | Conveyance Return Flows to Developed Supply - Managed Wetlands | | - | | | | - | | | | - | | | PSA/DAU |
| 18a | Conveyance Seepage - Urban | | - | | | | - | | | | - | | | PSA/DAU |
| b | Conveyance Seepage - Ag | | - | | | | - | | | | - | | | PSA/DAU |
| c | Conveyance Seepage - Managed Wetlands | | - | | | | - | | | | - | | | PSA/DAU |
| 19a | Recycled Water - Agriculture | | 10.5 | | | | 10.3 | | | | 10.3 | | | PSA/DAU |
| b | Recycled Water - Urban | | 5.7 | | | | 5.9 | | | | 5.9 | | | PSA/DAU |
| c | Recycled Water - Groundwater | | 6.2 | | | | 6.2 | | | | 6.2 | | | PSA/DAU |
| 20a | Return Flow to Developed Supply - Ag | | - | | | | - | | | | - | | | PSA/DAU |
| b | Return Flow to Developed Supply - Wetlands | | - | | | | - | | | | - | | | PSA/DAU |
| c | Return Flow to Developed Supply - Urban | | - | | | | - | | | | - | | | PSA/DAU |
| 21a | Deep Percolation of Applied Water - Ag | | - | | | | - | | | | - | | | PSA/DAU |
| b | Deep Percolation of Applied Water - Wetlands | | - | | | | - | | | | - | | | PSA/DAU |
| c | Deep Percolation of Applied Water - Urban | | 43.4 | | | | 44.0 | | | | 46.1 | | | PSA/DAU |
| 22a | Reuse of Return Flows within Region - Ag | | - | | | | - | | | | - | | | PSA/DAU |
| b | Reuse of Return Flows within Region - Wetlands, Instream, W&S | | - | | | | - | | | | - | | | PSA/DAU |
| 24a | Return Flow for Delta Outflow - Ag | | - | | | | - | | | | - | | | PSA/DAU |
| b | Return Flow for Delta Outflow - Wetlands, Instream, W&S | | - | | | | - | | | | - | | | PSA/DAU |
| c | Return Flow for Delta Outflow - Urban Wastewater | | - | | | | - | | | | - | | | PSA/DAU |
| 25 | Direct Diversions | N/A | | | | N/A | | | | N/A | | | | PSA/DAU |
| 26 | Surface Water in Storage - Beg of Yr | 491.3 | | | | 530.5 | | | | 505.7 | | | | PSA/DAU |
| 27 | Groundwater Extractions - Banked | - | | | | - | | | | - | | | | PSA/DAU |
| 28 | Groundwater Extractions - Adjudicated | - | | | | - | | | | - | | | | PSA/DAU |
| 29 | Groundwater Extractions - Unadjudicated | 72.1 | | | | 142.8 | | | | 217.6 | | | | REGION |
| **Withdrawals:** | **In Thousand Acre-feet** | | | | | | | | | | | | | |
| 23 | Groundwater Subsurface Outflow | N/A | | | | N/A | | | | N/A | | | | REGION |
| 30 | Surface Water Storage - End of Yr | 567.6 | | | | 505.7 | | | | 449.4 | | | | PSA/DAU |
| 31 | Groundwater Recharge-Contract Banking | | - | | | | - | | | | - | | | PSA/DAU |
| 32 | Groundwater Recharge-Adjudicated Basins | | - | | | | - | | | | - | | | PSA/DAU |
| 33 | Groundwater Recharge-Unadjudicated Basins | | - | | | | - | | | | - | | | REGION |
| 34a | Evaporation and Evapotranspiration from Native Vegetation | | | | N/A | | | | N/A | | | | N/A | REGION |
| b | Evaporation and Evapotranspiration from Unirrigated Ag | | | | N/A | | | | N/A | | | | N/A | REGION |
| 35a | Evaporation from Lakes | | | | 10.1 | | | | 10.1 | | | | 9.8 | REGION |
| b | Evaporation from Reservoirs | | | | 104.4 | | | | 103.4 | | | | 98.8 | REGION |
| 36 | Ag Effective Precipitation on Irrigated Lands | | - | | | | - | | | | - | | | REGION |
| 37 | Agricultural Use | | 101.8 | 101.8 | 101.8 | | 122.7 | 122.7 | 122.7 | | 135.6 | 135.6 | 135.6 | PSA/DAU |
| 38 | Wetlands Use | | 6.2 | 6.2 | 6.2 | | 6.2 | 6.2 | 6.2 | | 6.2 | 6.2 | 6.2 | PSA/DAU |
| 39a | Urban Residential Use - Single Family - Interior | | 132.2 | | | | 131.0 | | | | 137.2 | | | PSA/DAU |
| b | Urban Residential Use - Single Family - Exterior | | 308.2 | | | | 305.9 | | | | 320.2 | | | PSA/DAU |
| c | Urban Residential Use - Multi-family - Interior | | 183.0 | | | | 184.9 | | | | 194.6 | | | PSA/DAU |
| d | Urban Residential Use - Multi-family - Exterior | | 45.7 | | | | 46.2 | | | | 48.6 | | | PSA/DAU |
| 40 | Urban Commercial Use | | 212.4 | | | | 223.2 | | | | 234.6 | | | PSA/DAU |
| 41 | Urban Industrial Use | | 53.1 | | | | 55.9 | | | | 58.6 | | | PSA/DAU |
| 42 | Urban Large Landscape | | 80.6 | | | | 91.2 | | | | 96.9 | | | PSA/DAU |
| 43 | Urban Energy Production | | - | | | | - | | | | - | | | PSA/DAU |
| 44 | Instream Flow | | 23.1 | 23.1 | 23.1 | | 21.5 | 21.5 | 21.5 | | 20.0 | 20.0 | 20.0 | PSA/DAU |
| 45 | Required Delta Outflow | | - | - | - | | - | - | - | | - | - | - | PSA/DAU |
| 46 | Wild & Scenic Rivers Use | | - | - | - | | - | | - | | - | - | - | PSA/DAU |
| 47a | Evapotranspiration of Applied Water - Ag | | | | 78.3 | | | | 94.7 | | | | 104.2 | PSA/DAU |
| b | Evapotranspiration of Applied Water - Managed Wetlands | | | | 3.1 | | | | 3.1 | | | | 3.1 | PSA/DAU |
| c | Evapotranspiration of Applied Water - Urban | | | | 303.0 | | | | 307.9 | | | | 322.6 | PSA/DAU |
| 48 | Evaporation and Evapotranspiration from Urban Wastewater | | | | - | | | | - | | | | - | REGION |
| 49 | Return Flows Evaporation and Evapotranspiration - Ag | | | | - | | | | - | | | | - | PSA/DAU |
| 50 | Urban Waste Water Produced | 582.8 | | | | 598.4 | | | | 628.5 | | | | REGION |
| 51a | Conveyance Evaporation and Evapotranspiration - Urban | | | | 7.1 | | | | 6.9 | | | | 6.2 | PSA/DAU |
| b | Conveyance Evaporation and Evapotranspiration - Ag | | | | 0.5 | | | | 0.6 | | | | 0.7 | PSA/DAU |
| c | Conveyance Evaporation and Evapotranspiration - Managed Wetlands | | | | - | | | | - | | | | - | PSA/DAU |
| d | Conveyance Loss to Mexico | | | | - | | | | - | | | | - | PSA/DAU |
| 52a | Return Flows to Salt Sink - Ag | | | | 24.0 | | | | 28.6 | | | | 32.1 | PSA/DAU |
| b | Return Flows to Salt Sink - Urban | | | | 675.9 | | | | 693.3 | | | | 726.8 | PSA/DAU |
| c | Return Flows to Salt Sink - Wetlands | | | | 3.1 | | | | 3.1 | | | | 3.1 | PSA/DAU |
| 53 | Remaining Natural Runoff - Flows to Salt Sink | | | | 23.1 | | | | 21.5 | | | | 20.0 | REGION |
| 54a | Outflow to Nevada | | | | - | | | | - | | | | - | REGION |
| b | Outflow to Oregon | | | | - | | | | - | | | | - | REGION |
| c | Outflow to Mexico | | | | - | | | | - | | | | - | REGION |
| 55 | Regional Imports | 308.7 | | | | 309.2 | | | | 273.9 | | | | REGION |
| 56 | Regional Exports | 0.0 | | | | 0.0 | | | | 0.0 | | | | REGION |
| 59 | Groundwater Net Change in Storage | -70.4 | | | | 114.5 | | | | -150.7 | | | | REGION |
| 60 | Surface Water Net Change in Storage | 76.3 | | | | -24.8 | | | | -56.3 | | | | REGION |
| 61 | Surface Water Total Available Storage | 746.1 | | | | 746.1 | | | | 746.1 | | | | REGION |

Colored spaces are where data belongs. N/A Data Not Available "-" Data Not Applicable "0" Null value

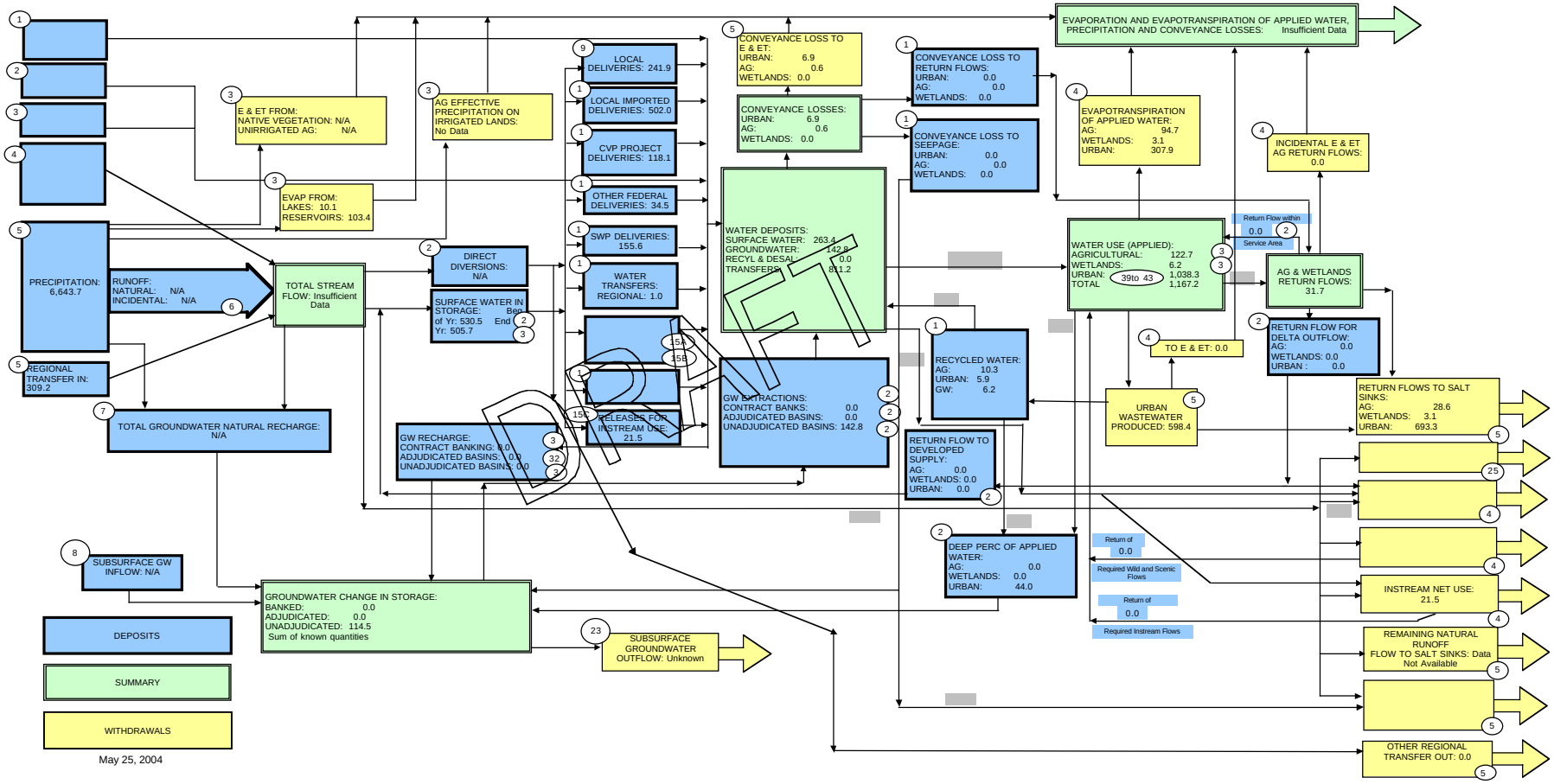
## Table 3-3
## San Francisco Bay Hydrologic Region Water Use and Distribution of Dedicated Supplied

| | 1998 | | | 2000 | | | 2001 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Applied Water Use | Net Water Use | Depletion | Applied Water Use | Net Water Use | Depletion | Applied Water Use | Net Water Use | Depletion |
| **WATER USE** | | | | | | | | | |
| **Urban** | | | | | | | | | |
| Large Landscape | 80.6 | | | 91.2 | | | 95.5 | | |
| Commercial | 212.4 | | | 223.2 | | | 234.6 | | |
| Industrial | 53.1 | | | 55.9 | | | 58.6 | | |
| Energy Production | 0.0 | | | 0.0 | | | 0.0 | | |
| Residential - Interior | 315.2 | | | 315.9 | | | 331.8 | | |
| Residential - Exterior | 353.9 | | | 352.1 | | | 368.8 | | |
| Evapotranspiration of Applied Water | | 303.0 | 303.0 | | 307.9 | 307.9 | | 322.6 | 322.6 |
| Irrecoverable Losses | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Outflow | | 668.8 | 668.8 | | 686.4 | 686.4 | | 720.6 | 720.6 |
| Conveyance Losses - Applied Water | 14.2 | | | 13.8 | | | 12.4 | | |
| Conveyance Losses - Evaporation | | 7.1 | 7.1 | | 6.9 | 6.9 | | 6.2 | 6.2 |
| Conveyance Losses - Irrecoverable Losses | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Conveyance Losses - Outflow | | 7.1 | 7.1 | | 6.9 | 6.9 | | 6.2 | 6.2 |
| GW Recharge Applied Water | 14.4 | | | 13.6 | | | 10.4 | | |
| GW Recharge Evap + Evapotranspiration | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| **Total Urban Use** | **1,043.8** | **986.0** | **986.0** | **1,065.7** | **1,008.1** | **1,008.1** | **1,112.1** | **1,055.6** | **1,055.6** |
| **Agriculture** | | | | | | | | | |
| On-Farm Applied Water | 101.8 | | | 122.7 | | | 135.6 | | |
| Evapotranspiration of Applied Water | | 78.3 | 78.3 | | 94.7 | 94.7 | | 104.2 | 104.2 |
| Irrecoverable Losses | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Outflow | | 23.5 | 23.5 | | 28.0 | 28.0 | | 31.4 | 31.4 |
| Conveyance Losses - Applied Water | 1.0 | | | 1.2 | | | 1.4 | | |
| Conveyance Losses - Evaporation | | 0.5 | 0.5 | | 0.6 | 0.6 | | 0.7 | 0.7 |
| Conveyance Losses - Irrecoverable Losses | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Conveyance Losses - Outflow | | 0.5 | 0.5 | | 0.6 | 0.6 | | 0.7 | 0.7 |
| GW Recharge Applied Water | 0.0 | | | 0.0 | | | 0.0 | | |
| GW Recharge Evap + Evapotranspiration | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| **Total Agricultural Use** | **102.8** | **102.8** | **102.8** | **123.9** | **123.9** | **123.9** | **137.0** | **137.0** | **137.0** |
| **Environmental** | | | | | | | | | |
| Instream | | | | | | | | | |
| Applied Water | 23.1 | | | 21.5 | | | 20.0 | | |
| Outflow | | 23.1 | 23.1 | | 21.5 | 21.5 | | 20.0 | 20.0 |
| Wild & Scenic | | | | | | | | | |
| Applied Water | 0.0 | | | 0.0 | | | 0.0 | | |
| Outflow | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Required Delta Outflow | | | | | | | | | |
| Applied Water | 0.0 | | | 0.0 | | | 0.0 | | |
| Outflow | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Managed Wetlands | | | | | | | | | |
| Habitat Applied Water | 6.2 | | | 6.2 | | | 6.2 | | |
| Evapotranspiration of Applied Water | | 3.1 | 3.1 | | 3.1 | 3.1 | | 3.1 | 3.1 |
| Irrecoverable Losses | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Outflow | | 3.1 | 3.1 | | 3.1 | 3.1 | | 3.1 | 3.1 |
| Conveyance Losses - Applied Water | 0.0 | | | 0.0 | | | 0.0 | | |
| Conveyance Losses - Evaporation | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Conveyance Losses - Irrecoverable Losses | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Conveyance Losses - Outflow | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Total Managed Wetlands Use | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 |
| **Total Environmental Use** | **29.3** | **29.3** | **29.3** | **27.7** | **27.7** | **27.7** | **26.2** | **26.2** | **26.2** |
| **TOTAL USE AND LOSSES** | **1,175.9** | **1,118.1** | **1,118.1** | **1,217.3** | **1,159.7** | **1,159.7** | **1,275.3** | **1,218.8** | **1,218.8** |
| **DEDICATED WATER SUPPLIES** | | | | | | | | | |
| **Surface Water** | | | | | | | | | |
| Local Deliveries | 273.4 | 273.4 | 273.4 | 241.9 | 241.9 | 241.9 | 231.7 | 231.7 | 231.7 |
| Local Imported Deliveries | 500.3 | 500.3 | 500.3 | 502.0 | 502.0 | 502.0 | 529.9 | 529.9 | 529.9 |
| Colorado River Deliveries | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| CVP Base and Project Deliveries | 120.6 | 120.6 | 120.6 | 118.1 | 118.1 | 118.1 | 114.7 | 114.7 | 114.7 |
| Other Federal Deliveries | 38.6 | 38.6 | 38.6 | 34.5 | 34.5 | 34.5 | 37.7 | 37.7 | 37.7 |
| SWP Deliveries | 148.5 | 148.5 | 148.5 | 155.6 | 155.6 | 155.6 | 121.3 | 121.3 | 121.3 |
| Required Environmental Instream Flow | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Groundwater** | | | | | | | | | |
| Net Withdrawal | 14.3 | 14.3 | 14.3 | 85.2 | 85.2 | 85.2 | 161.1 | 161.1 | 161.1 |
| Artificial Recharge | 14.4 | | | 13.6 | | | 10.4 | | |
| Deep Percolation | 43.4 | | | 44.0 | | | 46.1 | | |
| **Reuse/Recycle** | | | | | | | | | |
| Reuse Surface Water | 0.0 | | | 0.0 | | | 0.0 | | |
| Recycled Water | 22.4 | 22.4 | 22.4 | 22.4 | 22.4 | 22.4 | 22.4 | 22.4 | 22.4 |
| **TOTAL SUPPLIES** | **1,175.9** | **1,118.1** | **1,118.1** | **1,217.3** | **1,159.7** | **1,159.7** | **1,275.3** | **1,218.8** | **1,218.8** |
| *Balance = Use - Supplies* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* |

## Figure 3-2
## San Francisco Bay Hydrologic Region 1998 Flow Diagram



## Figure 3-3
## San Francisco Bay Hydrologic Region 2000 Flow Diagram



## Figure 3-4
## San Francisco Bay Hydrologic Region 2001 Flow Diagram